Effect of Microgravity on Early Events of Biological Nitrogen Fixation in *Medicago truncatula*: Initial results from the SyNRGE experiment.

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SyNRGE (Symbiotic Nodulation in a Reduced Gravity Environment) was a sortie mission on STS-135 in the Biological Research in Canisters (BRIC) hardware to study the effect of microgravity on a plant-microbe symbiosis resulting in biological nitrogen fixation. *Medicago truncatula*, a model species of the legume family, was inoculated with its bacterial symbiont, *Sinorhizobium meliloti*, to observe early events associated with infection and nodulation in Petri Dish Fixation Units (PDFUs). Two sets of experiments were conducted in orbit and in 24-hour delayed ground controls. Experiment one was designed to determine if *S. meliloti* infect *M. truncatula* and initiate physiological changes associated with nodule formation. Roots of five-day-old *M. truncatula* cultivar Jemalong A17 *(Enod11::gus)* were inoculated 24 hr before launch with either *S. meliloti* strain 1021 or strain ABS7 and integrated into BRIC-PDFU hardware placed in a 4°C Cold Bag for launch on *Atlantis*. Inoculated plants and uninoculated controls were maintained in the dark at ambient temperature in the middeck of STS-135 for 11 days before fixation in RNA*later*™ by crew activation of the PDFU. Experiment two was designed to determine if microgravity altered the process of bacterial infection and host plant nodule formation. Seeds of two *M. truncatula* cultivar Jemalong A17 lines, the *Enod11::gus* used in experiment 1, and SUNN, a super-nodulating mutant of A17, were germinated on orbit for 11 days in the middeck cabin and returned to Earth alive inside of BRIC-PDFU's at 4°C. *S. meliloti* strains 1021 and ABS7 were cultivated separately in broth culture on orbit and also returned to Earth alive. After landing, flight- and ground-grown plants and bacteria were transferred from BRIC-PDFU's into Nunc™ 4-well plates for reciprocity crosses. Rates of plant growth and nodule development on Buffered Nodulation Medium (lacking nitrogen) were measured for 14 days. Preliminary analysis of Experiment 1 confirms that legumes and bacteria cultivated in space initiate the symbiotic interaction leading to nitrogen fixation and that bacteria retain the ability to form nodules on *M. truncatula* roots. Initial assessment of experiment 2 shows 100% seed germination and excellent bacterial growth in microgravity. (Research supported by NASA ESMD/Advance Capabilities Division grant NNX10AR09A).